

A preliminary study on fruit production in certain plants

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INTRODUCTION

During the course of an ecological study on a fruit-feeding bird, the Cape Bulbul, *Pycnonotus capensis*, it was necessary to establish, quantitatively and qualitatively, the natural fruit and seed production of the food plants used by the bird. This paper presents the results of a large number of field records taken in an attempt to establish this fruit and seed production in coastal bush near Port Elizabeth.

The concept of an orthodox annual cycle of spring, summer, autumn and winter originated in the northern hemisphere under cool-temperature conditions. There, because of the short and definite seasons, it is assumed that all plants flower and produce seed or fruit regularly. In South Africa where drought is a phenomenon that may exist at all times at one place or another (Wellington 1955) the annual cycle is often disrupted. Consequently the ecological scene is one of irregular flowering, early, normal, late or entirely absent. It is unpredictable from one year to the next and seed or fruit may be in extraordinary abundance or sometimes entirely lacking. When seed or fruit is lacking it is not only because of insect or animal predation, as has been established for cool-temperate regions (Weaver and Clements 1938). Such a state of affairs in southern Africa is probably brought about through environmental conditions disrupting the normal reproductive rhythm which, in some trees at least may have a two or four year cycle (Phillips 1931).

THE VEGETATION TYPE

The area studied is situated halfway between the town of Port Elizabeth and Cape Recife at the end of a promontory that lies to the south-east of the town on the coastal dunes (Figure 1). According to Acocks (1953), this area falls under Alexandria Forest complex in subsection called Dune Forest. However, the two indicator species used by Acocks for Dune Forest are absent in the area of study. In fact the "coastal woodland" of Martin and Noel (1960 p. viii) is very much nearer to the vegetation of this area than any other vegetation type described. The plant species mentioned by Martin and Noel under coastal heath are all present. In addition there is a heavy intrusion by the exotic wattle, *Acacia cyclops*, dominant in much of the area.

The main woody plants include *Sideroxylon inerme*, *Rhus crenata*, *Maytenus procumbens*, *Euclea racemosa*, and *Cassine maritima*. Elements of fynbos such as *Agathosma apiculata* and *Coleonema pulchrum*, dominate patches of the shorter coastal heath.

THE AREA OF STUDY

The study area is a narrow strip approximately 20 hectares in extent. From the coastal dunes it runs back 100 to 200 metres to the fence of the Humewood Golf Course and approximately a kilometre long. The dunes are from three to ten metres high with a main ridge



Fig. 1. Showing the actual study area of wasted bush and heath with the suburb of Summerstrand in background.

parallel to the coast above and behind high tide level. Several valleys run at right-angles to this ridge, extending inland. This break-up of the dunes and lack of regularity affords numerous slopes which are protected from the fairly strong prevailing westerly or easterly winds. A feature of the vegetation around the promontory is the severe wind-blown appearance of the coastal bush. In the study area the prevailing westerly wind comes over land and the on-shore easterly wind has apparently little effect on the vegetation. Consequently the life-form is normal for the species except perhaps that *Sideroxylon inerme* does not develop into a tree and, in fact, on some dunes has a prostrate growth, keeping it between thirty and sixty centimetres high though it may fruit prolifically under such conditions. Analysis from aerial survey photographs indicates that 35% of the area is covered by woodland/scrub; 61% covered by coastal heath and 4% is road and roadworks.

The whole study area is on a loamy sand—indeed it forms part of several square kilometres of what was referred to as the Witsands Forestry Reserve. This indicates the extent of the loamy sandsoil in this area. Rainfall is evenly distributed throughout the year; 48% of the precipitation has been recorded between October and March, 52% in the other half year. The lowest rainfall figures for the year are generally in January, with the SE. and SW. winds predominating, and 28½% calm days in July with a westerly wind dominant.

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Fig. 2. Showing graphically the natural fruit production for the main plant species studied. (Note: The scale of the ordinate is not the same for all species). Climatic conditions also shown.

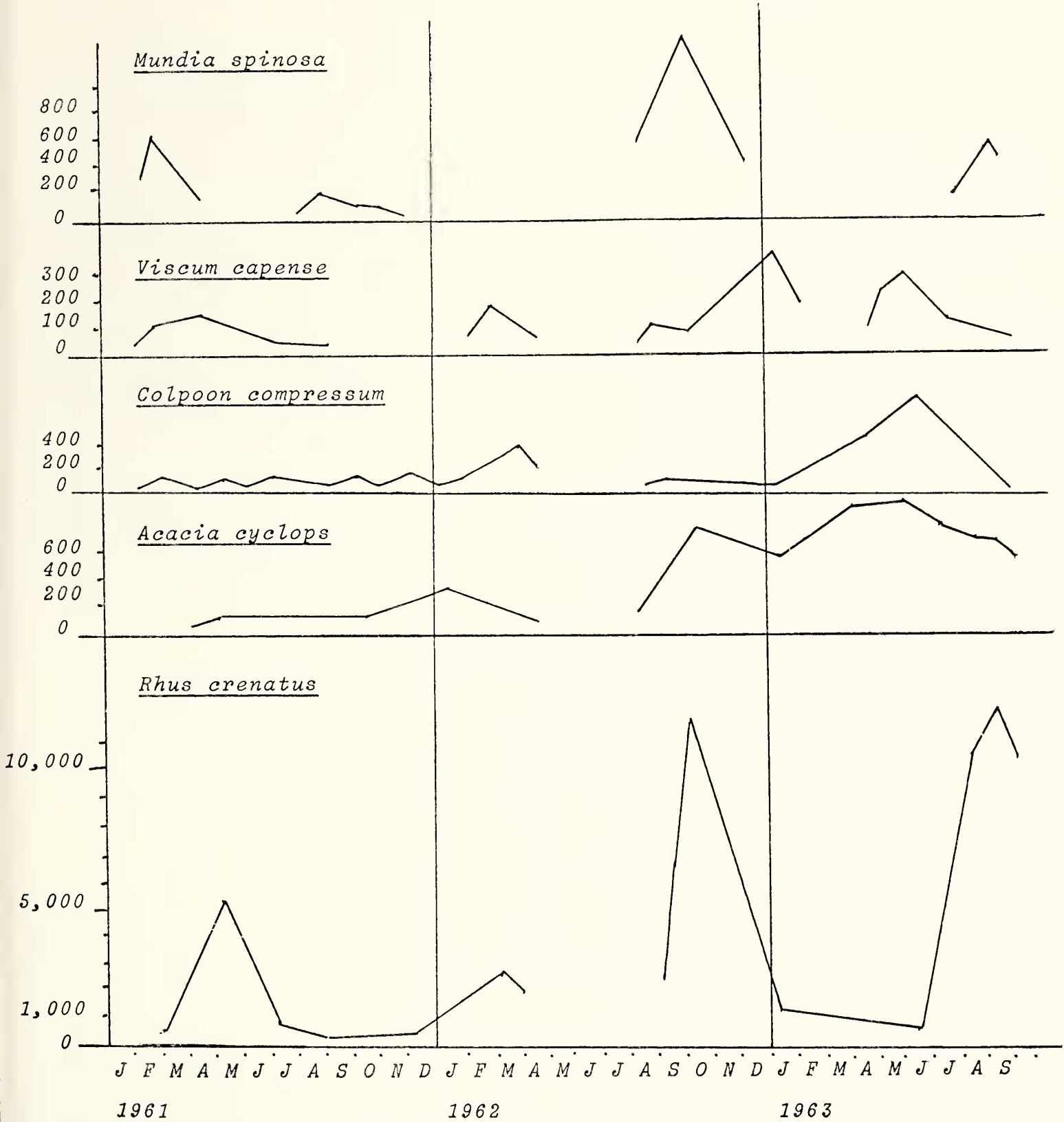
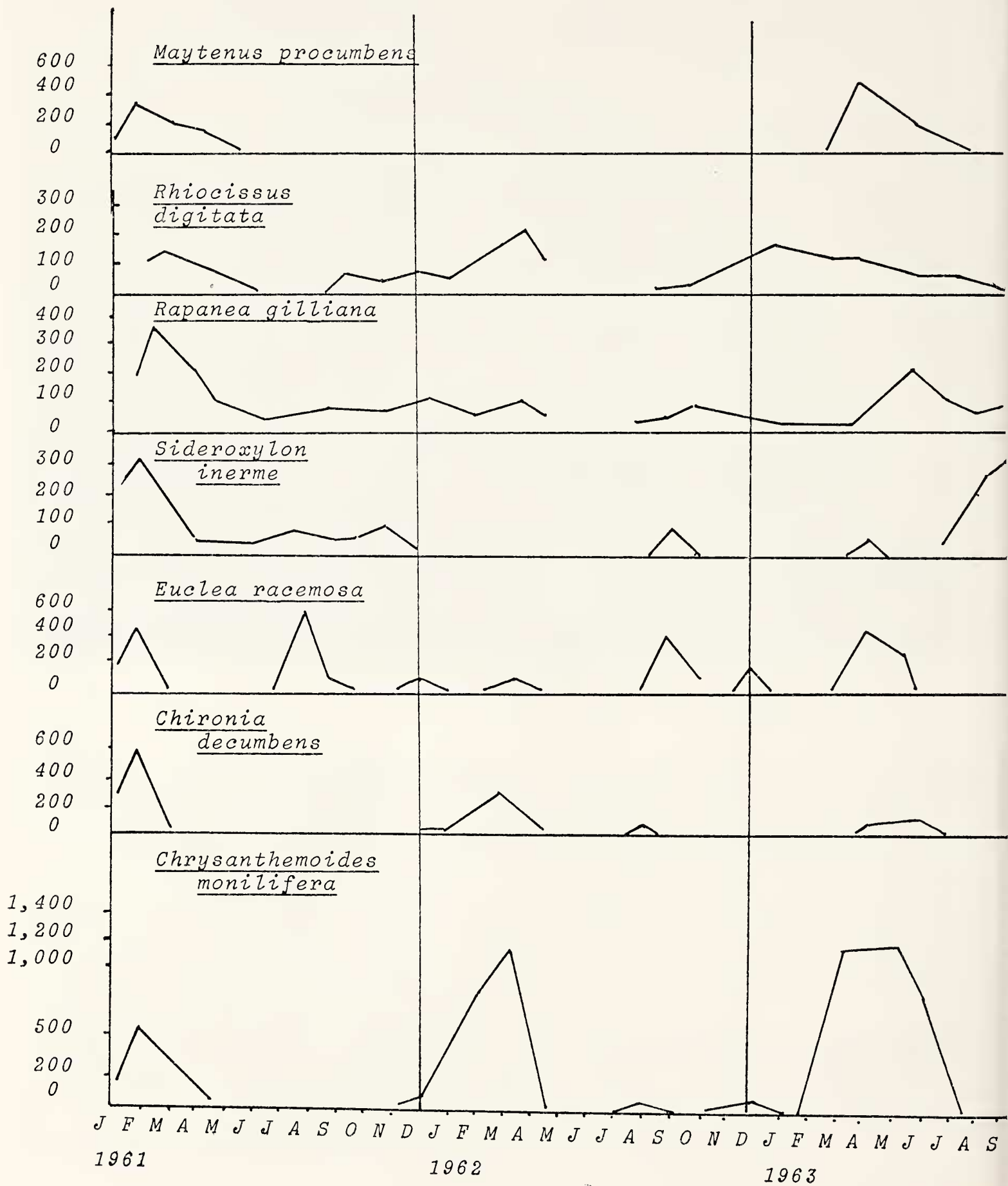
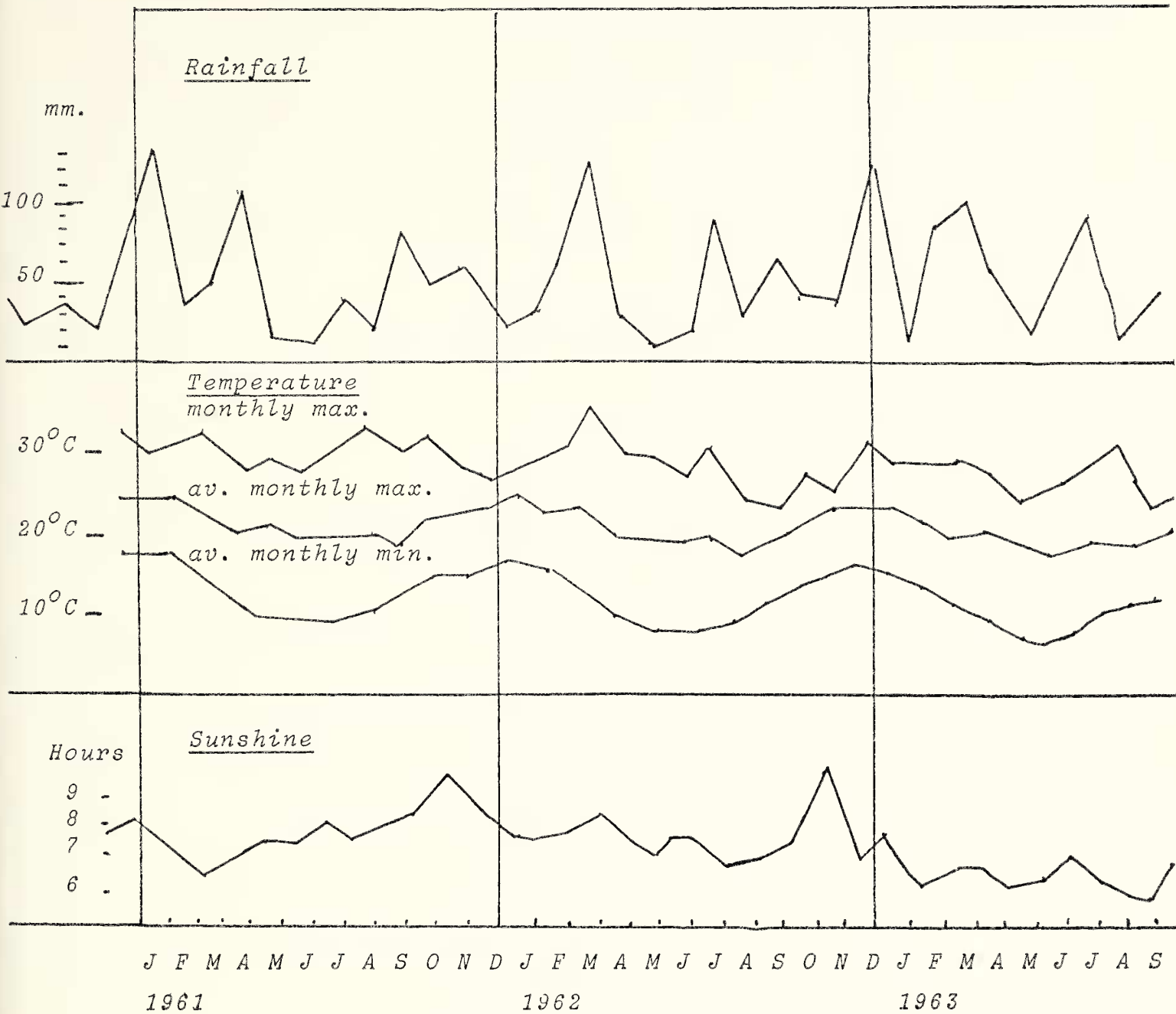


Fig. 2. (Continuation)



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Fig. 2. (Continuation)



FIELD METHOD

The aims of this survey were to establish the availability of fruits eaten by the Cape Bulbul both in respect to seasons and quantities at all times of the year. After trials of various methods, a simple field procedure was adopted which is unrefined but has the merit of being practical and of giving a fair comparative result. Three selected paths were taken to cover different areas—one on the edge of bush and fynbos (120 metres), one from the top of a dune down into the dune valley (110 metres) and the third in a protected valley (100 metres). Detailed notes were made at monthly intervals recording for each bush whether flowers, green fruits or ripe fruits were present. The number of fruits from every bush along the route that lay within 80 centimetres (arms length) of the path, on both sides of the path, was counted or estimated when numerous. The height of each bush was recorded approximately so that

the individual bush was recognizable from year to year. During peak fruiting times a number of ripe fruits were taken and weighed on a triple beam balance.

This system would have been more satisfactory if a cyclostyled form had been used indicating each plant on a route, and giving height; presence, numbers or absence of flowers; green or ripe fruits; also presence or absence of young leaves.

From a fruit production point of view it is not so important to know the actual number of flowers produced by a plant. Very often if the flowers are "out of season" the correct insect for pollination may not be available (see under *Chrysanthemoides monilifera*) and this will influence fruit production. Another factor is the predation by birds, which often prevents fruits reaching maturity. *Colpoon compressum* always had a few red fruits and only once was a fully ripe, purplish fruit seen on a bush. This was when the fruit-eating birds were attracted elsewhere by the abundance of food on another plant.

While the work was concerned only with the production on those food plants utilized by the bird under study, details were kept of all larger plants. The results concerning all plants are given in Appendix 1.

RESULTS

The results of the observations on the fruit-bearing plants utilized by the Cape Bulbul are given in tabulated (Table 1) and graphical (Figure 2) form with the details for each species. Viewing these results, it is apparent that flowering and fruiting of at least some of the twenty-four species discussed occurs throughout the year. Some species show a regular annual cycle,

TABLE 1. Showing the flowering and fruiting seasons of plants under observation for three years at Cape Recife. The maximum and minimum number of fruits, green and ripe, are given, as well as number of bushes under observation.

f = flower b = fruit brackets used for irregular incidence of either

Species	January	February	March	April	May	June	July	August	September	October	November	December	Nos. of green fruits recorded	Nos. of ripe fruits recorded	No. of months flowering	No. of months to ripen fruits	No. of plants counted
<i>Brunsvigia</i> sp.		f	f	f	f.b	b	b	f.b	f.b	f.b			20-350	30-53	3	1-2	—
<i>Viscum capense</i>		f	f.b	f.b	f.b	b	b	f.b	f.b	f.b			20-350	30-53	3-4	$\frac{1}{2}$	4
<i>Viscum</i> sp.									b						1	$\frac{1}{2}$	1
<i>Colpoon compressum</i>	f.b	f.b	f.b	b	f.b	f.b	f.b	f.b	f.b	f.b	f.b	f.b	25-539	1-105	11	3	11
<i>Acacia cyclops</i>	f.b	f.b	b	(f)b	(f)	b	(f)	(f)	(f)	f.b	f.b	f.b	20-680	3-235	5	11	9
<i>Carpobrotus edulis</i>							f	f	f.b	b	b	b			3	3	—
<i>Agathosma apiculata</i>						f	f	f.b	f.b	f.b					4	1	—
<i>Coleonema pulchrum</i>				f	f	f	f	f	f.b	f.b	b				7	4-5	6
<i>Mundia spinosa</i>			b	f.b	f.b	f	f	f	f.b	f.b	b	b	60-840	5-420	7	3	11
<i>Rhus crenata</i>	f.b	f	f.b	b	b	f.b	f.b	f	f.b	f.b	b	b	60-2 600	40-9 100	3-4	3-4	48
<i>Rhus glauca</i>					f	b	(b)	(b)	b	b			14-400	300	1	2-3	1
<i>Maytenus procumbens</i>		f	f.b	f.b	f.b	b	b	b	b				450-4 980	345-1 320	4	3	17
<i>Cassine maritima</i>			b	b	b	b	b						50-1 140	30	1	3-4	8
<i>Cassine tetragona</i>	f.b	f.b	f.b	f.b	b	b	b		b		f	f	20-330	40-200	1	1	3
<i>Rhiocissus digitata</i>	f.b	f.b	f.b	b	b	b	b	b	b	b	f.b	f.b	8-179	1-143	5	3-6	11
<i>Passerina rigida</i>	f.b	b							f	f.b	f.b	f.b			5	1	—
<i>Rapanea gilliana</i>	b		b	b	f.b	f.b	f.b	b	b	b	b	b	25-200	25-220	3	4-6	6
<i>Sideroxylon inerme</i>	f.b	b	b	b	b	b	b	f.b	f.b	f.b	f.b	f.b	48-350	5-50	6	9	6
<i>Fuclea racemosa</i>	b	b	f.b	b	b	b		f	f	b	b		9-600	1-4500	1-2	1-2	3
<i>Olea exasperata</i>	f.b		f.b	f.b	f.b	f	f.b		f			f.b		3-440	8	1	2
<i>Chironia decumbens</i>	f	f	f.b	b	b	b			b			f	20-470	23-160	4	4	9
<i>Salvia africana-lutea</i>							f	f	f	f					4	—	—
<i>Solanum quadrangulare</i>		f	f	f	f	f	f	f.b							7	1	—
<i>Chrysanthemoides monilifera</i>	f.b	f.b	f.b	b		b	b	f.b	f.b	f.b	f	f	17-1 600	6-290	8	3-5	16
Total no. species flowering each month	11	11	12	8	9	7	10	12	13	10	6	9					
Total no. species in fruit each month	11	8	15	15	12	13	10	9	16	15	11	10					

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the remainder are irregular in their fruiting. The irregularly fruiting species may have a half-yearly, yearly or biennial cycle which varies slightly according to seasonal changes.

Though records were kept of individual bushes the results are not presented in detail. This is mainly because of lack of regular monthly counts but partly because of uncertainty as to what took place between counts. A minimum of regular fortnightly counts is required to give adequate figures for detailed information. Mention is made under the species of points taken from these chronological records of individual bushes. Some bushes appeared to be heavier bearers than others nearby but the data are too few to prove this point. Indeed, two seasons may show a reversal between two bushes—what was formerly the heavy bearer may the next season have a poor crop compared with the neighbouring bush.

FLOWERING

It is assumed that the interval between budding and the ripening of the fruit is more or less constant in individual species. It is self-evident that the fruiting period depends for the

TABLE 2. The weight of fruits recorded at different times as well as dry weights (oven dried at 10°C for 48 hours) of some fruits.

	Date	Wt of 100 fruits	Dry wt of 100 fruits	% increase in weight over lowest
		grammes	grammes	recorded wt
<i>Viscum capense</i>	9. 3.64	12,5	—	—
<i>Acacia cyclops</i>	—	17,3	4,69	—
	6.12.69	8,9	5,12	—
<i>Acacia cyclops</i> : aril only	—	7,3	1,27	—
	6.12.69	7	1,63	—
<i>Mundia spinosa</i>	30.11.62	57,3	—	—
	6.12.69	49,5	11,36	16
<i>Rhus crenata</i>	31. 7.61	1,37	0,66	—
	30.10.62	2,10	—	53
<i>Maytenus procumbens</i>	27. 3.61	13,4	8,29	—
	3. 5.63	39,4	—	194
<i>Cassine maritima</i>	31. 7.61	18,2	4,67	—
<i>Rhycissus digitata</i>	30. 3.62	28,7	—	—
<i>Rapanea gilliana</i>	31. 7.61	43,6	5,87	—
	3. 5.63	72,2	—	66
	3. 6.63	76,2	—	75
<i>Sideroxylon inerme</i>	27. 3.61	7,6	—	—
<i>Euclea racemosa</i>	30. 1.63	9,6	2,59	—
	30. 3.62	13,1	—	37
	9. 3.64	14,0	—	46
	27. 3.61	17,1	2,59	78
	26. 4.63	22,0	—	130
	3. 6.63	28,8	—	300
<i>Olea exasperata</i>	27. 3.61	22,0	8,05	—
	3. 6.63	28,8	—	31
<i>Chironia decumbens</i>	27. 3.61	10,3	—	—
	30. 3.62	13,4	—	30
	9. 3.64	13,7	—	33
<i>Chrysanthemoides monilifera</i>	30. 3.62	15,0	—	—
	26. 4.63	19,4	—	29
<i>Solanum sp.</i>	6.12.69	61,9	8,37	—

most part on the period of flowering. Thus if flowering is early it is likely that ripe fruit will also occur early. Exceptions occur when flowering is out of phase with the pollinating agent (see *Chrysanthemoides*), or when fruit fails to mature (see *Rapanea*) for various reasons mainly connected with unseasonable weather periods.

Flowering in the area occurs throughout the year (Table 1). Of the 24 species of plants reported the number flowering each month varied from a minimum of 7 to a maximum of 13. The highest numbers per month fell into two periods from July to September and January to March. The length of the flowering period for each species varied from one month to eleven months. Eight species flowered for only one or two months and nine species flowered for more than six months of the year.

FRUIT PRODUCTION

With the variation in time between budding and ripe fruit from two weeks to eleven months depending on the species, it is interesting to find two peaks for the number of species fruiting in a year. Autumn, March to May, is the most prolific period of fruiting and a secondary peak occurs in spring, from September to November. The average number of plants fruiting agrees closely with the flowering—namely 10,0 per month. The least number of species fruiting in one month was seven and the greatest thirteen.

The variation in fruit production is considerable, both quantitatively and qualitatively. Reference to Table 1 indicates the extremes in number of unripe fruits in any one species along the routes taken to be 60 minimum to 2 600 maximum for *Rhus crenata* and 450 to 4 980 in *Maytenus procumbens*. For ripe fruits the extremes counted were 40 to 9 100 for *Rhus crenata*. The quality of the fruits varied from season to season. While most fell between 34 to 119% difference of fruit weight from year to year, the greatest difference recorded was in *Maytenus procumbens*. In this species 13,4 g for 100 heads was recorded one year and 37,4 g for the next crop two years later (Table 2).

DISCUSSION

Phillips (1931: 245) pointed out that there was practically no information then concerning the biology of the flowers and fruits of the more important trees and shrubs. Little progress has been made since 1931. Phillips himself gives details of 63 species of trees and woody shrubs occurring at Knysna. The only species in his work in Knysna and the coastal-bush under study are *Euclea racemosa* and *Sideroxylon inerme*.

It is shown above (Table 2) that the timing, quantity and quality of fruits varies from year to year. Phillips (loc. cit. p. 246) has shown how complex these matters are: "Individual plants near the sea flower and fruit several weeks to months before their relatives in the inland plateau or mountain kloof (forest) patches". Coastal conditions are usually slightly warmer and rather drier than inland. Flowers are sometimes further advanced and more prolific on individual plants on the warmer northern or north-western aspects. Species near the coast flower more prolifically than those inland, a point which can be correlated with the observation that trees in the drier forests usually bear richer crops than those in moist forests—bearing in mind that this is relatively speaking, since all the forests are moist forests in the region discussed. These differences would explain several of the differences in flowering time as recorded in the study area from those of the Albany and Bathurst division (taken from Martin & Noel 1960).

Details of fruit production in relation to climate are given in Figure 2. If, in fact, these two can be correlated it becomes possible to predict fruit crops in advance. The problem is not so much correlating peak of crop with peak in weather but why peak in weather does

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not always result in peak in crop. A rest period for the plant (which need not be required at all times of the year) would probably explain some observations. Flower production at periods when pollinating agents are unavailable would also influence fruit production.

The difference in *size* of fruit available is not so easily correlated with climatic factors. If we refer to Figure 2 it can be seen that actual rainfall one month prior to fruit production in general was very much less in 1961 than 1962. Also temperature were ascending at this time in 1962 and warmer weather may have helped.

It is unlikely that degree of pollination differed markedly. *Rhus laevigata* is poorly pollinated by *Apis mellifera* and *Apis caffra*. Ants are active on *Rhus crenata* throughout the year. The two months of probable pollination had good rainfall but the minor peak of fruit production in the autumn of 1962 occurred when the rainfall was rather low. Predation on buds and young ovaries in these plants is known to take place in the area of study, particularly by members of the seedeater family, *Fringillidae*. This, however, is unlikely to have a significant influence on the fruit crops of such heavy producers as were studied.

The observed facts are too limited to be able to suggest reasons for seasonal variations in fruit production. They do, however, show the irregularity of season and production from year to year. From an ecological point of view it is desirable to determine the variables that affect fruit production, and the time of fruit ripening.

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APPENDIX

Details of flowering and fruiting of plants presented in order according to that used by Martin and Noel 1960.

AMARYLLIDACEAE

Brunsvigia sp.: Common in open areas of coastal heath, this spectacular flower appears from February to April, the leaves appearing from June to August.

LORANTHACEAE

Viscum capense L.f.: The Cape Mistletoe is a fairly common parasite in the area. Flowering and fruiting occurs in the spring and autumn; the fruit is ripe in a couple of weeks. Flowers and berries were not produced in spring, 1961 and autumn 1963.

Viscum (species unknown): This is a larger leafed plant with larger fruit. Recorded in fruit in September 1962, only.

SANTALACEAE

Colpoon compressum Berg: A fairly common tall shrub usually occurring in clumps within the bush. Recorded flowering throughout the year in the study area, though only from April to October in the Albany and Bathurst flora. There is a period of about three months before fruit is ripe and the main fruiting season is from April to July. No green fruits were recorded in May.

The only occasion fully ripe purple fruits were recorded was on 26th April 1963. This month, *Chrysanthemoides*, the favourite food of the Cape Bulbul and *Maytenus*, and the favourite of the Sombre Bulbul, *Andropadus importunus*, were at peak fruit production. Both birds feed upon *Colpoon* normally but during this time they fed elsewhere, this allowing the *Colpoon* fruits to ripen. This is the only period in three years when this was noted.

There was no major production of fruit in the autumn of 1961 such as there was in 1962 and 1963.

LEGUMINOSAE

Acacia cyclops Cunn.: This alien wattle (*Rooikrans*) was introduced into the area to bind the sand dunes. It has become dominant in the general area and several patches occurred within the study area.

Flowering occurs prolifically and simultaneously throughout the area at the time the pods ripen. This is from October through to February. A few flowers may be present at other times, though none were recorded for March and June. Young pods are noticeable from January though more were recorded from March onward. By June the pods are almost full-sized and green.

The pods become brown in Spring and by October they begin to crack open, showing a red fleshy aril. The dry pods open with quite a loud crackling noise during January and February, ejecting the dried red aril and seed. The peak period of abundance of ripe pods varies; January in 1961, December in 1961 whilst there was an extended period from October 1962 to January 1963—evidently a “good” year.

This plant is frequently cut for firewood, and most trees under study were eliminated so that individual bush records were not available.

AIZOACEAE

Carpobrotus edulis (L) N.E.Br.: The “hottentot fig” is a common ground cover on the sandy areas where it sometimes forms solid patches. Flowering occurs from late July through to September, with fruits from September onwards. This species appears to have a more regular annual cycle than many other local plants.

RUTACEAE

Agathosma apiculata G. F. W. Mey apud Bartl. & Wendl.: Common on the flat areas of coastal heath. Flowering begins in late June and extends through to October in the study area, though it is recorded until January in the Albany and Bathurst areas. Fruits do not remain much later than the flowers, being recorded from August to October.

Coleonema pulchrum Hook.f.: Present in patches, this attractive little shrub is in flower most of the year, though few flowers were present from November to March. Seed heads were recorded from September to November.

POLYGALACEAE

Mundia spinosa DC: The “waxberry” is a common low bush on the sand dunes and was locally abundant enough to form the supply for a small wax industry in the early days of Port Elizabeth. Flowering is recorded from April to October, with the height of blooming in

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July in each year. The waxy fruit ripens about three months after flowering, for reasons which are not apparent, for the facts do not fit in with flowering times. The berry crop has two distinct seasons, March to May, and the more important spring crop October to December. Timing of flowering and berry production is uniform and simultaneous in the study area. Crops were produced in the spring of 1961, 1962 (no observation—spring 1963) and autumn 1964. One bush which produced a good spring 1962 crop produced a poor autumn 1964 crop whilst two which had poor and good crops respectively in spring 1962 had good crops in autumn 1964. Individual variation thus occurs.

ANACARDIACEAE

Rhus crenata Thunb.: Perhaps the commonest indigenous shrub, it is widely distributed throughout the study area. Though not clearly shown in Table 1, this species has two flowering seasons each year and consequently two fruiting seasons. The fruit ripens in three to four months. Berry production does not occur every spring and autumn. Very poor berry crops were produced in the spring of 1961 and autumn of 1963. Furthermore, the autumn crops of 1961 and 1962 were very much lower than those of the springs of 1962 and 1963. Not only was there a quantitative difference but also a qualitative difference between crops. Thus 100 berries in the autumn of 1961 weighed 1,37 g whereas the same number of berries weighed 2,10 g in the spring of 1962, an increase of 53% by weight.

Individual bushes may flower twice in a year whilst another bush may miss out a flowering period and thus have three crops in two years. One bush had only one good crop in two years. There is thus much individual variation between plants. This results in a wider flowering and fruiting period than other plants.

Rhus glauca Desf.: This larger-leaved *Rhus* is less common than the previous species and tends to occur in the coastal heath areas. Only one specimen was subject to observation. This individual flowered in May 1961 and had fruits again two years later in June and September 1963. This indicates the possibility of a species which flowers every second year. In view of the variability shown by *Rhus crenata* this needs confirmation. Fruits ripen about three months after flowering.

CELASTRACEAE

Maytenus procumbens (L.f.) Loes.: Common but not dominant except in localized patches of growth. Flowering was noted from February to May, green fruits from March to June and ripe fruits from April to September. In the area under study, flowering and fruiting occurred in 1959, 1961 and 1963 indicating a two-year cycle. Of some interest is that all the plants in the surrounding areas had the same season. In other words fruits were only produced alternative years and as a food source for berry-eating birds this would have disadvantages.

Fruit production in 1963 was more prolific than in 1961. It should also be noted that the fruits too were larger and weighed nearly three times as much in 1963—100 fruits being 13,4 g in 1961 and 37,4 g in 1963, an increase of 193%.

Cassine maritima (Bol.) L.Bol.: Not uncommon tall shrub with small edible fruits. The flowers were recorded in January with fruits from March to July. This species only produced fruits in 1961 and 1963 and it is therefore believed to have a two-year cycle.

Cassine tetragona Loes.: There were only three plants along the paths taken for these counts; these three plants produced flowers and fruits only during the one summer, December to April 1962. It is probable that this species has a cycle longer than one year but the exact period is not determined. It should be noted that flowering is recorded in July for Albany and Bathurst.

VITACEAE

Rhicissus digitata Gilg et Brandt: This creeper is commoner growing on vegetation with a sheltered northern aspect, thus it occurs in patches. The flower is short lived and for this reason flowering was recorded only from November to March. Berries were recorded every month of the year but these may take several months to develop and ripen. On the one path where this species was common there was a peak production in the summer 1961–2 and the next peak was in winter 1963.

THYMELAEACEAE

Passerina rigida Wikstrom: This tall shrub is widely scattered in the survey area. Flowering occurs from September through to January with fruit recorded from October to January. It flowers annually regularly, with flowers and buds recorded 21st September 1961 and buds only on 21st September 1962.

MYRSINACEAE

Rapanea gilliana Mez.: This little bush is subject to considerable variations in its fruit production. The flower is short-lived and though flowers were only recorded May to July there appears to be a double crop of fruit each year. The fruit apparently requires rain for final development. During one dry period the fruits remained on the bushes for two months longer than normal, during which time they became sunburnt.

One bush had 100 fruits March 1961 and its second crop in September was only 16 fruits. In a stand of this species beyond the route recorded, prolific flowering was noted in August but no fruit was set, possibly because this flowering was abnormally late. Yet this same patch produced unusually numerous and large fruit seven months later. The fruit itself varies from crop to crop. Thus on 31st July 1961, 50 fruits weighed 21,8 g whilst on 3rd June 1963 the same number weighed 38,1 g, an increase of 75%. The size of a ripe fruit varied from 6–8 mm in diameter to 12 to 15 mm, on the same dates mentioned above.

SAPOTACEAE

Sideroxylon inerme L.: Locally a wind-formed low shrub, not uncommon. Buds and flowers were recorded from late August to late January. This plant would seem to flower annually with fruits taking about nine months to develop from small and green to ripe. A peak production occurred in March 1961 and again in November 1963, and although the figures are inadequate to draw any conclusions there appears to be a difference quantitatively from year to year in peak fruit production.

EBENACEAE

Euclea racemosa Murr.: A fairly common shrub which grows, in this area, up to 2,20 m high. The same plant carries two crops of fruit in one year. Flowering occurs in August and again in March and the fruits ripen within four to six weeks. The seasons may vary from year to year by a month forward or a month later. There is also a considerable difference in quality of fruit from season to season—thus 50 ripe fruit weighed 6,34 g in March 1962; 11,0 g in April 1963 and 14,0 g in June 1963—a total increase of 119%.

OLEACEAE

Olea exasperata Jacq.: This shrub, which grows up to 2,20 m high, is patchy in its distribution. In exposed positions it remains only 6 cm tall. Recorded to flower in Albany from August to November, under local conditions it seems to flower most months of the year. Despite this prolific flowering fruits were recorded only in March and May 1961 and again in December–January 1961–2.

LIVERSIDGE: A PRELIMINARY STUDY ON FRUIT PRODUCTION

GENTIANACEAE

Chironia decumbens Levyns: This attractive low bush grows up to 60 cm high in patches in semi-open sandy spots. Though a definite flowering period occurs from December to March, the odd flower was recorded in other months. The flowering period is four months earlier than that recorded for Albany and Bathurst. The fruits take about four months to mature and thus ripe fruits occur for the most part from March to June.

There is some difference in quantity and quality of fruit crop from year to year. Thus a bigger crop of smaller fruits appeared in March 1961 and a smaller crop of bigger fruits was produced in April 1962, while in 1963 the crop was even later. Weight of 100 fruits on 27th March 1961 was 10,3 g and 35 on 30th March 1962 weighed 4,70 g, which represents an increase of 33%.

LABIATAE

Salvia africana-lutea L.: Locally this shrub occurs within patches of mixed species of shrubs about 1,20 m high. Flowering occurred from July to September in 1961 and 1963 and from September to October in 1962.

SOLANACEAE

Solanum quadrangulare Thunb.: This creeper was not common and its appearance seems short-lived. Flowering occurs over a long period from February through to August. Ripe berries were only recorded in August probably because they are quickly eaten by berry-feeding creatures and have little opportunity to ripen on the plant.

COMPOSITAE

Chrysanthemoides monilifera (L.) T.Norl.: Perhaps the commonest indigenous shrub, this plant grows up to 2,40 m high and is dominant in the vegetation. Flowering occurred annually from September (as early as August in 1963) through to March. The fruit took from three to five months to ripen.

Differences in season and quantity of flowers and fruit varied enormously from year to year. The heaviest flowering occurred in March 1961, when no insects were seen on the flowers and the subsequent fruit crop was the poorest of the three years. In 1962 the peak fruit production was recorded in April, while in 1963 this extended from April to June. One hundred fruits on 30th March 1962 weighed 13,7 g, while on 24th April 1962 the same number weighed 19,4 g, representing an increase of 34% by weight. It is interesting to note that a beetle, *Melyris interstitialis*, occurred on the flowers from October to December, and a green *Melyris sp.* from January and February. Individual bushes may not produce fruit each season.